3 Amp 5V Input Adjustable Integrated Switching Regulator

SLTS032A

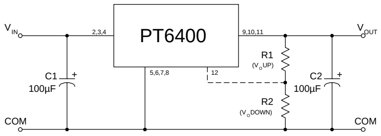
(Revised 6/30/2000)

- Single-Device 5V to 3V Power
- 85% Efficiency
- Small SIP Footprint
- Adjustable Output Voltage

The PT6400 is a high performance +5V to +3.3V, 3 Amp, 12-Pin SIP (Single In-line Package) Integrated Switching Regulator (ISR) designed for stand alone (not parallelable) operation. This high-performance ISR allows easy integration of low-power 3.3V logic IC's into existing 5V systems without redesigning the central power supply. Only two external capacitors are required for proper operation. The output voltage is easily adjustable with one external resistor. The PT6406,7,8 can be used to terminate high-speed data buses such as Futurebus (+2.1V) or the new GTL (+1.2V) logic buses.

Please note that this product does not include short circuit protection.

Standard Application



C_1 = Required 100µF electrolytic
C_2 = Required 100µF electrolytic

Pin-Out Information

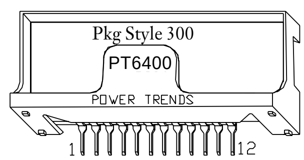
Pin	Function
1	Do not connect
2	V_{in}
3	V_{in}
4	V_{in}
5	GND
6	GND
7	GND
8	GND
9	V_{out}
10	V_{out}
11	V_{out}
12	V_{out}Adjust

Ordering Information

PT6404	= +1.5 Volts
PT6405	= +3.3 Volts
PT6406	= +1.8 Volts
PT6407	= +2.1 Volts
PT6408	= +1.2 Volts
PT6409	= +2.5 Volts

PT Series Suffix (PT1234X)

Case/Pin Configuration	
Vertical Through-Hole	**P**
Horizontal Through-Hole	**D**
Horizontal Surface Mount	**E**



Note: Back surface of product is conducting metal.

Specifications

Characteristics (T_a = 25°C unless noted)	Symbols	Conditions	PT6400 SERIES Min	Typ	Max	Units
Output Current	I_o	$4.5V \le V_{in} \le 5.5V$	0.1*	—	3.0	A
Current Limit	I_{cl}	V_{in} = +5V	—	3.6	5.0	A
Input Voltage Range	V_{in}	$0.1A \le I_o \le 3.0A$	4.5	—	5.5	V
Output Voltage Tolerance	ΔV_o	V_{in} = +5V, I_o = 3.0A $0°C \le T_a \le +70°C$	Vo-0.05	—	Vo+0.05	V
Line Regulation	Reg_{line}	$4.5V \le V_{in} \le 5.5V$, I_o = 3.0A	—	±10	±25	mV
Load Regulation	Reg_{load}	V_{in} = +5V, $0.3 \le I_o \le 3.0A$	—	±10	±25	mV
V_o Ripple/Noise	V_n	V_{in} = 5V, I_o = 3.0A	—	66	165	mV
Transient Response with C_2 = 100µF	t_{tr} V_{os}	I_o step between 1.5A and 3.0A V_o over/undershoot	— —	200 200	— —	µSec mV
Efficiency	η	V_{in} = +5V, I_o = 1.5A Vo= 3.3V Vo= 1.8V Vo= 2.1V Vo= 1.2V	— — — —	85 74 77 63	— — — —	% % % %
Switching Frequency	f_o	$4.5V \le V_{in} \le 5.5V$ $0.3A \le I_o \le 3.0A$	500	650	800	kHz
Absolute Maximum Operating Temperature Range	T_a		0	—	+85	°C
Recommended Operating Temperature Range	T_a	Free Air Convection (40-60 LFM) At Vin= 5V, Io=2.5A	0	—	+ 70**	°C
Thermal Resistance	θ_{ja}	Free Air Convection (40-60 LFM)	—	25	—	°C/W
Storage Temperature	T_s	—	-40	—	+125	°C
Mechanical Shock		Per Mil-STD-883D, Method 2002.3 , 1 msec, Half Sine, mounted to a fixture	—	500	—	G's
Mechanical Vibration		Per Mil-STD-883D, Method 2007.2, 20-2000 Hz, Soldered in a PC board	—	15	—	G's
Weight	—	—	—	6.5	—	grams

*ISR will operate down to no load with reduced specifications

**See Thermal Derating chart.

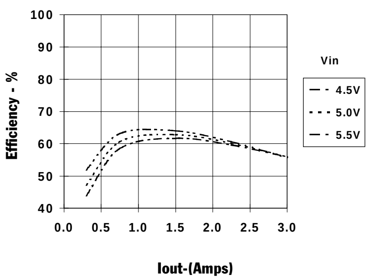
Note: *The PT6400 Series requires two 100µF electrolytic or tantalum capacitors for proper operation in all applications.*

PT6408, 1.2 VDC (See Note 1)

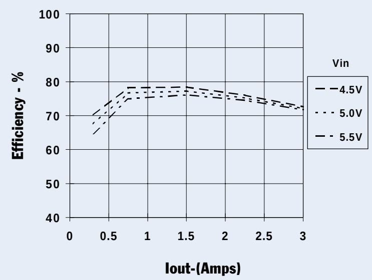
PT6407, 2.1 VDC (See Note 1)

PT6405, 3.3 VDC (See Note 1)

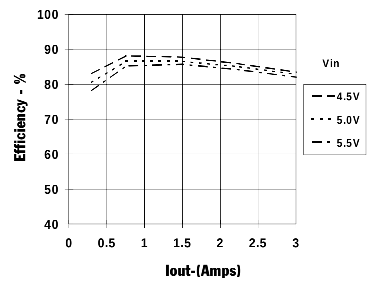
PT6408 — Efficiency vs Output Current



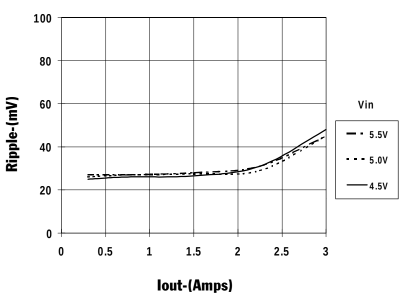
PT6407 — Efficiency vs Output Current



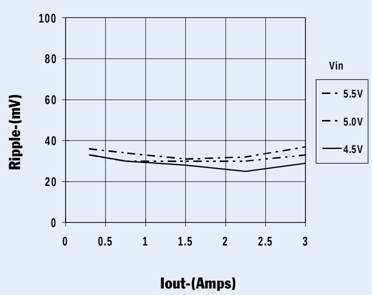
PT6405 — Efficiency vs Output Current



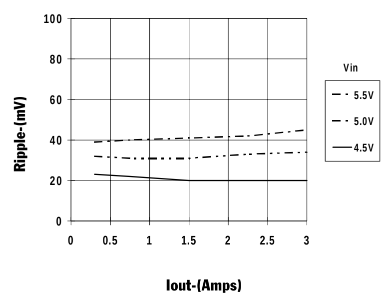
PT6408 — Ripple vs Output Current



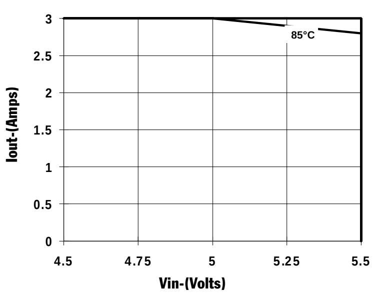
PT6407 — Ripple vs Output Current



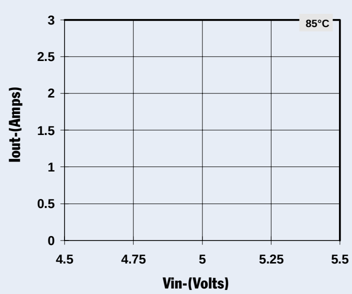
PT6405 — Ripple vs Output Current



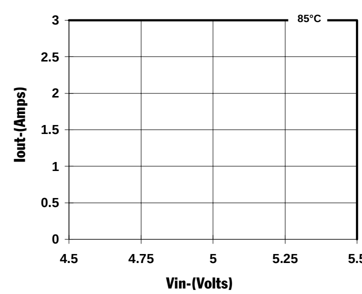
PT6408 — Thermal Derating (T_a) (See Note 2)



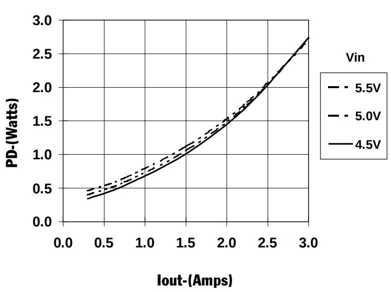
PT6407 — Thermal Derating (T_a) (See Note 2)



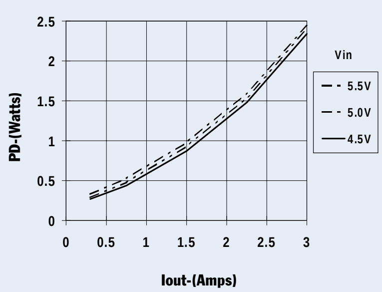
PT6405 — Thermal Derating (T_a) (See Note 2)



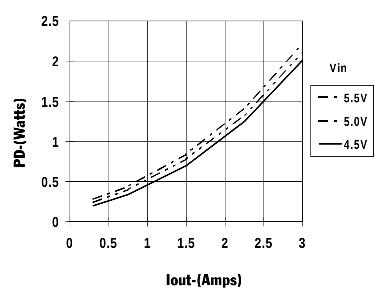
PT6408 — Power Dissipation vs Output Current



PT6407 — Power Dissipation vs Output Current



PT6405 — Power Dissipation vs Output Current



Note 1: *All data listed in the above graphs, except for derating data, has been developed from actual products tested at 25°C. This data is considered typical data for the ISR.*
Note 2: *Thermal derating graphs are developed in free air convection cooling of 40-60 LFM. (See Thermal Application Notes.)*

Adjusting the Output Voltage of the PT6400 Series 3AMP 5V Bus Converters

The output voltage of the Power Trends PT6400 Series ISRs may be adjusted higher or lower than the factory trimmed pre-set voltage with the addition of a single external resistor. Table 1 accordingly gives the allowable adjustment range for each model in the series as V_a (min) and V_a (max).

Adjust Up: (See note 1) An increase in the output voltage is obtained by adding a resistor R1, between pin 12 (V_o adjust) and pins 9-11 (V_{out}).

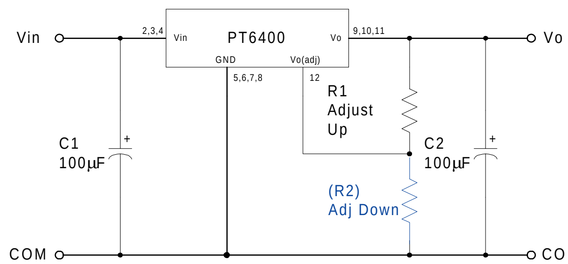
Adjust Down: (See note 1) Add a resistor (R2), between pin 12 (V_o adjust) and pins 5-8 (GND).

Refer to Figure 1 and Table 2 for both the placement and value of the required resistor; either R1 or (R2) as appropriate.

Notes:

1. The direction in which each resistor adjusts the output of the PT6400 series differs from many other Power Trends products. These output voltage adjustment notes are therefore specific only to the PT6400 models.
2. Use only a single 1% resistor in either the R1 or (R2) location. Place the resistor as close to the ISR as possible.
3. Never connect capacitors from V_o adjust to either GND or V_{out}. Any capacitance added to the V_o adjust pin will affect the stability of the ISR.
4. An increase in the output voltage may place additional limits on the input voltage range of the part. The revised minimum input voltage will be (V_{out} + 1.2) or 4.5V, whichever is higher. Do not exceed 5.5Vdc.

Figure 1



The values of R1 [adjust up], and (R2) [adjust down], can also be calculated using the following formulae.

$$R1 = \frac{12.45\ V_O}{(V_a - V_O)} - 49.9 \quad k\Omega$$

$$(R2) = \frac{12.45\ (2V_a - V_O)}{V_O - V_a} - 49.9 \quad k\Omega$$

Where: V_o = Original output voltage
V_a = Adjusted output voltage

Table 1

PT6400 ADJUSTMENT RANGE

Series Pt #	PT6408	PT6404	PT6406	PT6407	PT6409	PT6405
V_O (nom)	1.2	1.5	1.8	2.1	2.5	3.3
V_a (min)	1.1	1.3	1.5	1.8	2.1	2.8
V_a (max)	1.4	1.8	2.2	2.6	3.1	3.8

Table 2

PT6400 ADJUSTMENT RESISTOR VALUES

Series Pt #	**PT6408**	**PT6404**	**PT6406**	**PT6407**	**PT6409**	**PT6405**
V_o (nom)	**1.2**	**1.5**	**1.8**	**2.1**	**2.5**	**3.3**
V_a (req'd)						
1.1	(74.6)kΩ					
1.15	(224.0)kΩ					
1.2						
1.25	249.0kΩ					
1.3	99.5kΩ	(18.6)kΩ				
1.35	49.7kΩ	(49.7)kΩ				
1.4	24.8kΩ	(112.0)kΩ				
1.45		(299.0)kΩ				
1.5			(0.0)kΩ			
1.55		324.0kΩ	(14.8)kΩ			
1.6		137.0kΩ	(37.3)kΩ			
1.65		74.6kΩ	(74.6)kΩ			
1.7		43.5kΩ	(149.0)kΩ			
1.75		24.8kΩ	(373.0)kΩ			
1.8		12.4kΩ		(12.4)kΩ		
1.85			398.0kΩ	(29.8)kΩ		
1.9			174.0kΩ	(55.9)kΩ		
1.95			99.5kΩ	(99.5)kΩ		
2.0			62.2kΩ	(187.0)kΩ		
2.05			39.7kΩ	(448.0)kΩ		
2.1			24.8kΩ		(3.0)kΩ	
2.15			14.1kΩ	473.0kΩ	(14.1)kΩ	
2.2			6.1kΩ	212.0kΩ	(29.0)kΩ	
2.25				124.0kΩ	(49.7)kΩ	
2.3				80.8kΩ	(80.8)kΩ	
2.35				54.7kΩ	(133.0)kΩ	
2.4				37.3kΩ	(236.0)kΩ	
2.45				24.8kΩ	(548.0)kΩ	
2.5				15.5kΩ		
2.55				8.2kΩ	573.0kΩ	
2.6				2.4kΩ	261.0kΩ	
2.65					158.0kΩ	
2.7					106.0kΩ	
2.75					74.6kΩ	
2.8					53.9kΩ	(7.4)kΩ
2.85					39.0kΩ	(16.5)kΩ
2.9					27.9kΩ	(27.9)kΩ
2.95					19.3kΩ	(42.6)kΩ
3.0					12.4kΩ	(62.2)kΩ
3.1					2.0kΩ	(131.0)kΩ
3.2						(336.0)kΩ
3.3						
3.4						361.0kΩ
3.5						156.0kΩ
3.6						87.0kΩ
3.7						52.8kΩ
3.8						32.3kΩ

R1 = Black R2 = (Blue)

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